CLAIMS

What is claimed is:

1. A method for operating a synchronous space division multiple access, code division multiple access communications system, comprising:

within a coverage area of a base station (BS), assigning the same spreading code to a plurality of subscriber stations (SSs); and

beamforming using an antenna array at the BS so as to maximize the signal to interference plus noise ratio for a signal transmitted from a desired SS by steering a null towards another same-code SS to minimize interference from the same-code SS.

2. A method as in claim 1, wherein the antenna array has M-elements (M>1), wherein individual ones of P orthogonal spreading codes are reused αM times within the coverage area, where $1/M<\alpha\leq 1$.

3. A method as in claim 1, wherein the step of beamforming comprises a step of despreading the signal received from the desired SS, followed by a step of spatial filtering.

4. A method as in claim 1, wherein the step of beamforming comprises steps of operating the subscriber stations to obtain channel estimates comprised of the path amplitude and phase from each of *m* BS antenna elements and to send the *m* channel estimates back to the BS as a spatial signature vector, and where the BS, from the spatial signature vectors received from a plurality of same-code subscriber stations, computes antenna element weight vectors.

5. A synchronous space division multiple access, code division multiple access communications system, comprising a base station having a coverage area and a set of subscriber stations disposed within said coverage area, said base station comprising an adaptive antenna array for receiving transmissions from said set of subscriber stations and for transmitting signals to said set of subscriber stations, wherein a subset of subscriber stations comprises a plurality of same-code subscriber stations that are assigned an identical spreading code, said base station comprising beamforming circuitry coupled to said adaptive antenna array for maximizing the signal to interference plus noise ratio for a signal transmitted from one of said same-

code subscriber stations by steering a null towards others of said same code same-code subscriber stations to minimize interference from the others of said same-code subscriber stations.

6. A system as in claim 5, wherein said antenna array comprises M-elements (M>1), wherein individual ones of P orthogonal spreading codes are reused αM times within the coverage area, where $1/M<\alpha\leq 1$.

7. A system as in claim 5, wherein said beamforming circuitry comprises a despreader for despreading a signal received from said same-code subscriber station and a spatial filter having an input coupled to an output of said despreader.

8. A system as in claim 6, wherein said system has a maximum system capacity of αMP channels.

9. A system as in claim 5, wherein for a case of independent fading on each antenna element of said antenna array, said system achieves a diversity gain of M, where M is equal to the number of antenna elements of said antenna array.

10. A system as in claim 5, wherein subscriber stations obtain channel estimates comprised of the path amplitude and phase from each of m BS antenna elements and transmit the m channel estimates back to the BS as a spatial signature vector, and where said BS, from the spatial signature vectors received from a plurality of same-code subscriber stations, computes antenna element weight vectors.